TECHNICAL NOTES

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Growth of Northern Red Oak Seedlings Under Variable Conditions of Ground Cover Competition

A direct seeding made in the spring of 1950 on the Hardies Creek Timber Harvest Forest 1/ in Trempealeau County, Wisconsin, shows that the density and character of the ground cover had an important effect on the survival and growth of northern red oak regeneration.

The entire area sown was under a closed canopy of 90-year-old mixed oak. The three classes of ground cover were as follows:

Dense fern.--Located in a deep ravine on a north exposure. Sensitive fern, 2 or 3 feet in height, blanketed the ground from early summer until the first killing frost. This cover remained remarkably stable during the entire 5-year period.

Woody shrubs.--Occurred on an upper, northeast slope. The oak seedlings had to compete with blackberry, raspberry, gooseberry, and grey dogwood. These woody shrubs were 4 to 5 feet tall and became progressively more rank between 1950 and 1954.

Bluegrass sod.--Situated on an upland ridge where bluegrass and associated plants formed a sparse sod. The density of this turf did not change materially during the period of investigation.

Three 1/100-acre plots totaling 60 seed spots were established in each of the foregoing classes of vegetative cover. As a means of evaluating losses due to rodents, 30 spots in each replication were screened and 30 were left unprotected during the first growing season. All nine plots were situated on Fayette silt loam soil.

Despite their known viability, only a small percentage of the acorns developed into first-year seedlings (table 1). The lowest germination occurred on the bluegrass sod, and the highest was recorded on the woody-shrubs site. Initial establishment of oak on screened spots was 57 percent higher than on unprotected scalps. Ultimately, the poorest survival resulted from the severe competition by sensitive ferns where 77 percent of the small trees died. Approximately 60 percent of these losses occurred between July and mid-September of the first growing season.

Annual height measurements taken indicate considerable physiological dieback. The cause of the dieback is not known, but shading, winter kill, or frost injury are logical possibilities. Further studies of this phenomenon are needed.

1/ One of eight state-owned tracts where research projects are being carried on cooperatively by the Lake States Forest Experiment Station, the Wisconsin Conservation Department, and the office of the Extension Forester at the University of Wisconsin.

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There is a striking difference in the physical development of the oak seedlings under the dense fern as contrasted to the other ground cover classes (table 2). Not only do these young trees have a much smaller average weight than those for the other two lots, but they also are spindly, with a poor top-root ratio.

Another significant fact brought out by this study is that northern red oak seedlings can survive under relatively poor light conditions and vigorous root competition for a much longer period than is commonly believed.

Table 1.--Germination, survival, and growth of northern red oak seedlings in three ground cover classes

Ground cover class	First-year germination 1/		Survival of seedlings at end of--		Average height at end of--	
	Screened spots	Open spots	First year	Fifth year	First year	Fifth year
	Percent	Percent	Number	Number	Inches	Inches
Dense fern	30.0	23.3	48	11	3.8	7.1
Woody shrubs	36.7	18.9	50	45	4.0	8.1
Bluegrass sod	11.1	7.8	17	12	3.3	6.1
Total or average	25.9	16.7	115	68	3.8	7.6

1/ Based on total number of acorns sowed; 180 seeds were planted in each ground cover class.

Table 2.--Air-dry weight and top-root ratio of 5-year-old red oak seedlings grown in three ground cover classes

Ground cover class	Total weight for--		Average weight for--			Top-root ratio
	Smallest	Largest	All	Tops	Roots	
	Grams	Grams	Grams	Grams	Grams	
Dense fern	0.6	3.8	2.0	0.9	1.1	0.82
Woody shrubs	1.1	11.6	4.8	1.3	3.5	.37
Bluegrass sod	1.3	14.1	6.0	1.2	4.8	.25

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